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METHOD FOR PRODUCING FOOD INGREDIENT USING GINSENG
[Yakuyo Ninjin Wo Mochiita Shokuyo Sozai No Seizoho]

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SPECIFICATION

1. Title

Method for Producing Food Ingredient Using Ginseng

2. Claims

A method for producing a food ingredient using ginseng by inoculating a substrate that contains a crushed product, ground product, or extract of ginseng with lactobacillus and by fermenting it while maintaining its pH at 4.0 or higher, preferably 4.5 or higher.

3. Detailed Description of the Invention

Field of Industrial Application

The present invention intends to process ginseng without losing its active components in the process of fermenting ginseng with lactobacillus for improving its taste, and it is utilized when ginseng is used as a food ingredient.

Prior Art

Ginsengs, such as Asian ginseng, American ginseng, Siberian ginseng, and so forth, are known to have such efficacies as health promoting and adaptogenic effects, and they have long been used as medicines extensively. It is also known that their main active ingredients are saponins, including various kinds of ginsenosides.

In China and Korea, ginsengs are used in meals as ingredients for Yakuzen [translator's note: meals prepared based on the traditional Chinese medical theories and believed to have medicinal efficacies] and the like, but they have strong distinct bitterness and also odors,

such as muddy odor or the like. Therefore, when they are used in food, the amount that can be used is extremely limited, and they affect the taste if used even in a modest amount. Therefore, they are rarely used as ordinary food ingredients.

As fermented food that utilizes ginseng, yogurt is known (Japanese Unexamined Patent Publication No. Sho. 63-216432.) This is prepared by crushing ginseng together with water and subsequently eliminating the solid content, thereby obtaining a ginseng juice, and inoculating and fermenting it with lactobacillus directly or after adding sugar or dairy products, and it is intended to be eaten as is. Fermenting ginseng to utilize it as any other food ingredient has not been practiced heretofore.

Problems that the Invention Intends to Solve

As seen in the comparative test example, according to the findings that the present inventors obtained, fermenting a ginseng ingredient by adding lactobacillus to it causes its pH to decrease usually to pH 3.7 or lower as the fermentation progresses, and, if fermentation nutrients, such as sugar, etc., are added, the pH could decrease even further, to 3.5 or lower. In such a low level of pH, ginsenosides, which are the active components of ginseng, are found to decrease, and it was learned that, once the pH reaches 3.0 or below, ginsenosides completely disappear.

The present invention intends to improve the taste of ginseng by fermenting it without losing its active components.

By doing so, the present invention intends to provide food ingredients that contain the active components of ginseng at a high level and that also have excellent tastes, and it also intends to provide tasty food products that contain the active components of ginseng.

Means for Solving the Problems

The present inventors learned that ginsenosides, which are the active components of ginseng, are relatively stable until the pH reaches 4.0 but decrease once the pH becomes 3.8 or below, and the present invention was achieved based on this finding.

The present invention prepares food ingredients from ginseng by inoculating a crushed product, ground product, or extract of ginseng or a substrate that contains these with lactobacillus and by fermenting it while maintaining its pH at 4.0 or higher, preferably 4.5 or higher.

As the ginseng, the present invention can use plants of the Araliaceae family, such as Asian ginseng, American ginseng, Siberian ginseng, Chikusetsu ginseng [Panax japonicas], and Sanshichi ginseng [Panax notoginseng], especially the plants of the genus Panax, Eleutherococcus, and Gynura, as well as tissue culture products and the like of these plants.

With respect to the portion of these plants to be used, stems are commonly used from Siberian ginseng and roots from other ginsengs, such as Asian ginseng, American ginseng, and so forth, but the present

invention, not limited to these, can use any other portion that contains saponins. The present invention can also use ginsengs in any desired state, such as a raw or dried state.

Prior to the fermentation process, ginseng first undergoes a crushing, grinding, or extracting process.

When ginseng is crushed or ground, it may be processed as is, but it is preferable to add water before the process. More specifically, a food cutter or the like is used to shred ginseng, to which is then added water in a quantity of from 50 to 400 % of the ginseng, and this mixture is processed by, for example, a method that crushes it with a mixer or any other known crushing apparatus or a method that grinds the shredded ginseng with a grinding apparatus, such as a disk-shaped grinder, etc.

The extraction is carried out by mixing shredded, crushed, or ground ginseng with water in a quantity suitable for the application. Alternatively, after the ginseng is extracted with a solvent, such as an alcohol aqueous solution, etc., the solvent is eliminated by vacuum concentration, etc., thereby bringing the ginseng into a condition that allows the proliferation of lactobacillus.

Next, the thus obtained ginseng processed product, such as the crushed, ground, or extracted product of ginseng, is inoculated with lactobacillus and fermented. As the lactobacillus used here, the present invention can use any desired lactobacillus, such as those

that are used in such food products as yogurt, cheese, Japanese pickles, and so forth.

Prior to the fermentation, the present invention may add such food ingredients as crushed vegetables or fruits or their juices, dairy products, teas, coffee, cocoa, saccharides, etc., to the ginseng processed product.

For the purpose of eliminating sundry germs to allow the fermentation to progress smoothly, the ginseng processed product is preferably subjected to a sterilization process, such as heat sterilization, etc., prior to the inoculation with lactobacillus.

The fermentation is carried out while the acids generated by fermentation are neutralized by a known method--for example, by a method that adds a hardly-soluble alkali agent, such as calcium carbonate, etc., to the ginseng processed product, a method that adds a buffering agent to it, or a method that occasionally add an alkali solution one drop at a time as the fermentation progresses--so that the pH does not reach 4.0 or below. However, if the fermentation is continued with the pH that is close to 4.0, an unexpected pH drop could occur due to a slight increase in the fermentation activity, which could cause the active components to decrease. Therefore, it is preferable to conduct the fermentation at about pH 4.5. Alternatively, the present invention may employ a method that terminates the fermentation once the pH is decreased to about 4.3 as a result of the fermentation, thereby preventing the pH from reaching 4.0 or below.

Prior to the fermentation, fermentation nutrients, such as sugars, amino acids, vitamins, minerals, and so forth, may be added, as necessary, to the ginseng processed product.

The fermentation is carried out in a temperature range in which the lactobacillus employed can proliferate, and this has the effect of improving the taste of ginseng. More specifically, the fermentation is preferably carried out at a temperature that is within the temperature range of from 25 to 40 °C and that is approximately the optimal proliferation temperature of the selected lactobacillus or 5 °C or so below that temperature.

In addition, the fermentation is preferably carried out in a still condition or under gentle stirring. Stirring vigorously is not desirable because it inhibits the formation of lactic acid and could generate a bad odor due to abnormal fermentation. In the case of conducting the fermentation without the addition of sugars or other fermentation nutrients, terminating the fermentation when the sugars derived from the raw material have been used up can still yield a satisfactory taste improving effect. In the case of conducting the fermentation with the addition of fermentation nutrients, such as sugars, etc., it is recommended to terminate the fermentation when the lactobacillus, which was inoculated at a rate of, for example, 10^4 cells/g, has proliferated to about $10^{[illegible]}$ cells/g or when 0.4 % or thereabouts, based on the culture solution, of lactic acid is generated. However, even before this stage, the taste improvement can

be observed, and the progress of the fermentation beyond this stage does not affect the taste adversely. This means that the fermentation can be terminated at any desired stage.

The ginseng processed product that has been fermented with lactobacillus in the aforesaid manner does not have a bitter taste or give off an unpleasant odor, such as a muddy odor or the like, and becomes a food ingredient having an excellent taste.

Effects of the Invention

As will be shown in Working Examples 1 through 15, the ginseng fermentation products that were prepared according to the present invention had a better taste than the ginseng that was not fermented and became desirable products. Therefore, they can be utilized as food ingredients in the production of beverages, such as juices, drinks, nectars, etc.; frozen desserts, such as sorbets, ice candies, etc.; snacks, such as candies, jellies, baked snacks, etc.; soups; sweet alcoholic sake; miso pastes; cooked meals; and so forth.

Moreover, by utilizing the fermented products as is, products that contain the fiber, etc., of ginseng can be obtained, and, compared with the case of using them after the elimination of fiber, the resulting products become food ingredients having the effects of ginseng as well as the effects of fiber, thus rendering themselves more ideal for health maintenance. The supernatant obtained in the fermentation or the entire fermentation product may be dried and formed into a powder for use, and this powder can be used as a novel

food ingredient that can be utilized in chocolate, powder beverages, etc., which do not tolerate moisture.

Furthermore, as will be shown in the comparative test, conducting fermentation simply by adding lactobacillus decreases saponins, which are the active components of ginseng, and could cause them to disappear entirely, but, according to the present invention, the reduction of saponins is minimal, and the resulting products can maintain the insurance [sic] and health effects.

Working Examples 1 through 10

Three—year Asian ginseng roots were shredded with a food cutter, water in an amount three times that of ginseng was added, and the roots were crushed with a household-use mixer. This was heated at 100 °C for 20 minutes for sterilization. This sterilized Asian ginseng processed product had a pH of 5.6. Next, this was inoculated with each type of lactobacillus shown in Table 1 and fermented at 30 °C for 48 hours in a still condition, thereby obtaining a food ingredient.

During the fermentation, the pH was checked periodically, and, if necessary, a 1N sodium hydrogen carbonate solution was added one drop at a time to maintain the pH of the fermentation product at 4.5 or higher.

Using the food ingredient that was comprised of the Asian ginseng fermentation product thus obtained, an Asian ginseng beverage was formulated by mixing 10 parts (parts by weight, the same applies in

the following) of this with 10 parts sucrose, 0.2 part citric acid, and 80 parts water.

An organoleptic test was conducted with twenty-five panelists so as to compare the tastes of the beverages that were formulated in the working examples using, as the food ingredient, Asian ginseng that was fermented with various kinds of lactobacilli and of the beverage of the comparative example that was formulated in the same manner, using the non-fermented Asian ginseng that was subjected only to sterilization, and the obtained results are shown in Table 1.

TABLE 1: LACTOBACILLUS FERMENTATION EFFECTS ON RAW ASIAN GINSENG

Working Examples	Type of Lactobacillus	Organoleptic Test Results		
		a	b	c
1	Lactobacillus yogurti	25	0	0
2	Lactobacillus bulgaricus	25	0	0
3	Lactobacillus brevis	25	0	0
4	Lactobacillus casei	23	2	0
5	Lactobacillus plantarum	25	0	0
6	Lactobacillus batatas	25	0	0
7	Leuconostoc mesenteroides	23	2	0
8	Leuconostoc cremoris	25	0	0
9	Pediococcus pentosacius	25	0	0
10	Streptococcus thermophilus	24	1	0

"a" in the organoleptic test results indicates the number of panelists who preferred the beverage that was prepared from the lactobacillus-fermented Asian ginseng in each working example; "b", the number of panelists who had no preference between the beverage of each working example and the beverage of the comparative example; and "c", the number of panelists who preferred the beverage of the comparative example, which was prepared using Asian ginseng that was not subjected to a lactobacillus treatment.

Nitrogen gas was blown into each fermentation liquid to collect the volatile component through a Tenax concentration tube, and a gas chromatogram of the volatile component was obtained. As a result, it was learned that, compared with the gas chromatogram obtained by processing the non-fermented liquid in the same manner, the chromatogram obtained from every fermentation liquid showed a decrease in the quantities of sesquiterpene and the like, which are the components of the ginseng-specific odor. In addition, the quantity of crude saponins that were isolated from the supernatant of each fermentation liquid was measured using a SEP-PAK C-18 column and found to be from 2,000 to 2,400 μg/mL for every fermentation liquid, and, compared with that of the non-fermented ginseng liquid, which was 2,570 μg/mL, the decrease of saponins caused by the fermentation was very small in every case.

Furthermore, crude saponins were isolated from the supernatant of each fermentation liquid and from the supernatant of the non-fermented liquid, after which the isolated crude saponins were isolated by silica gel thin-layer chromatography (the developing solution was n-butanol: ethyl acetate: water = 4: 1: 5), and the size of each spot was measured with a chromato-scanner (CS-920, a product of Shimazu Co.) As a result, it was found that, assuming the spot of the non-fermented liquid as 1.0, the relative value of the corresponding spot of every fermentation liquid was within the range of from 0.8 to 1.3, which means that they were approximately the same.

Working Examples 11 through 15

Tissue-cultured Asian ginseng callus was mixed with an equal amount of water and crushed with a household use mixer.

Next, this was thermally sterilized at 100 °C for 20 minutes and then inoculated with each type of lactobacillus shown in Table 2 and fermented at 37 °C for 48 hours.

During the fermentation, the pH was checked periodically, and, if necessary, a 1N sodium hydrogen carbonate was added one drop at a time to maintain the pH at 4.5 or higher.

Every fermentation liquid thus obtained was less bitter than the non-fermented sterilized liquid and also did not have a muddy odor, and it had a pleasant taste with a sweet fragrance similar to that of yogurt or a refreshing acidic smell.

Using the supernatant of this Asian ginseng fermentation product as an ingredient, a beverage was prepared by mixing 10 parts of it with 10 parts sucrose, 0.2 part citric acid, and 80 parts water.

Table 2 shows the results of an organoleptic test that compared the Asian ginseng beverages of the working examples with the comparative example beverage that was obtained by processing the non-fermented Asian ginseng callus in the same manner as the fermentation liquid of each working example.

TABLE 2: LACTOBACILLUS FERMENTATION OF ASIAN GINSENG CALLUS

Working Examples	Type of Lactobacillus	Organoleptic Test Results		
		a	b	c
11	Leuconostoc mesenteroides	21	4	0
12	Pediococcus pentosacius	25	0	0
13	Lactobacillus casei	19	6	0
14	Lactobacillus batatas	21	4	0
15	Lactobacillus plantarum	21	4	0

As in Table 1, "a" in the organoleptic test results indicates the number of panelists who preferred the beverage that was prepared from the lactobacillus-fermented Asian ginseng in each working example; "b", the number of panelists who had no preference between the beverage of each working example and the beverage of the comparative example; and "c", the number of panelists who preferred the beverage of the comparative example, which was prepared using Asian ginseng that was not subjected to a lactobacillus treatment.

Working Example 16

Ten parts of dried Siberian ginseng was crushed and added to 90 parts of a 50 % ethyl alcohol aqueous solution, and, after it was soaked at 35 °C for 20 days, the extract was separated and concentrated under vacuum with an evaporator, thereby obtaining 10 parts of a concentrated extract.

To the thus obtained concentrated extract (10 parts) were added 10 parts of a 5 % glucose sugar solution and 0.2 part yeast extract, and the mixture was thermally sterilized at 100 °C for 16 minutes.

Next, the sterilized concentrated extract was inoculated with Pediococcus pentosacius and fermented at 35 °C for 24 hours in a still

condition. After 24 hours, the pH of the fermentation liquid reached 4.3., at which point the liquid was heated to terminate the fermentation.

Using this fermentation liquid as an ingredient, a Siberian ginseng beverage was prepared by mixing 10 parts of it with 10 parts sucrose, 0.3 part citric acid, and 80 parts water. This Siberian ginseng beverage had a pleasant mild taste without bitterness.

Comparative Test Result

Tissue-cultured Asian ginseng callus was mixed with an equal amount of water and crushed with a household—use mixer. Next, this was sterilized at 100 °C for 20 minutes and then inoculated with Lactobacillus plantarum and fermented at 37 °C in a still condition.

As the fermentation progressed, the pH decreased and, after 72 hours, reached 3.7. From the fermentation liquid that was being fermented, samples were taken in series as the pH decreased, and the quantities of ginsenosides in them were measured.

The quantities of ginsenosides were determined as follows. The crude saponin isolated from each sample was applied to a silica gel thin-layer plate and developed using, as the developing solution, a solution mixture of n-butanol: ethyl acetate: water = 4: 1: 5, after which the plate was sprayed with sulfuric acid and heated at 105 °C for 5 minutes to develop a color, and the size of each spot was found using a chromato-scanner and expressed as a value relative to the size of the spot, which was assumed to be 1.0, of the comparative sample

that was obtained by processing a non-fermented liquid in the same manner. This relative value was taken as the ginsenoside quantity. The obtained results are shown in Table 3.

The control was prepared by adding and mixing lactic acid into the comparative example sample to set the pH to 3.0.

TABLE 3: RELATIVE QUANTITY OF GINSENOSIDES

Samples	Fermentation Duration	pH	A	B	C
Comparative (non-fermented)	0	5.6	1.0	1.0	1.0
Sample 1	12	4.8	0.8	1.0	1.1
Sample 2	24	4.4	0.5	1.0	0.4
Sample 3	36	4.0	0.5	0.2	0.3
Sample 4	72	3.7	0.2	0	0
Control (lactic acid added)		3.0	0	0	0

"A" and "C" in Table 3 indicate the sum of the spots whose Rf values were 0.67 and 0.35, and "B" indicates the sum of the spots whose Rf values were 0.57 and 0.52. "A" was the spot corresponding to ginsenoside Rg_1.

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⑭発明の名称　薬用ニンジンを用いた食用素材の製造法

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明細書

1．発明の名称

薬用ニンジンを用いた食用素材の製造法

2．特許請求の範囲

薬用ニンジンの破砕物、磨砕物又は抽出物を含む基質に乳酸菌を接種し、pH4.0以上、好ましくはpH4.5以上に保ちながら発酵させることを特徴とする薬用ニンジンを用いた食用素材の製造法。

3．発明の詳細な説明

産業上の利用分野

この発明は、薬用ニンジンを乳酸菌で発酵して風味を改善する際、その有効成分を損なうことなく処理しようとするものであり、薬用ニンジンを食用素材として用いるとき利用される。

従来の技術

オタネニンジン、アメリカニンジン、エゾウコギなどの薬用ニンジンは、保健強壮、健胃などの効果が知られており、薬用として昔から広く利用されている。また、その主な有効成分が各種のジンセノサイドを含むサポニン類であることも知られている。

薬用ニンジンは、中国や韓国などでは菓餡などの材料として調理食品に用いられているが、特有の苦味が強く、しかも泥臭さなどの臭いもあるため、食品に用いる場合、使用量が著しく制限され、少し多く用いると風味が劣るものとなる。従って、通常の食用素材としては、ほとんど利用されていない。

薬用ニンジンを用いた発酵食品としてヨーグルト(特開昭63−216432号)が知られている。これは、薬用ニンジンを水と共に破砕した後固形分を除いた薬用ニンジンジュースを、直接又は糖若しくは乳製品を加えてから乳酸菌を接種し、発酵させたものであり、これを直接摂取するものである。なお、薬用ニンジンを発酵させ、他の食品の素材として利用することは、従来行われていなかった。

発明が解決しようとする課題

例えば比較試験例にも見られるように、この発

明の発明者らが得た知見によると、薬用ニンジン成分に乳酸菌を加えて発酵させると発酵の進行に従いｐＨが低下し、通常ｐＨ３．７或はそれ以下となり、糖などの発酵栄養成分を加えると３．５以下となることもある。このように低いｐＨでは、有効成分であるジンセノサイドの減少がみられ、ｐＨ３．０以下となるとジンセノサイドが全く存在しないものとなることが知られた。

この発明は、薬用ニンジンの有効成分を損なうことなく乳酸菌で発酵させ、風味を改良しようとするものである。

これにより薬用ニンジンの有効成分を高いレベルで含み、しかも風味の優れた食用素材を供することを目的としており、薬用ニンジンの有効成分を含み、風味の良好な食品を供することも目的としている。

課題を解決するための手段

この発明の発明者は、薬用ニンジンの有効成分であるジンセノサイドがｐＨ４．０までは比較的安定であるが、ｐＨ３．８以下となると減少することを見いだし、この発明を完成させた。

この発明は、薬用ニンジンの破砕物、磨砕物又は抽出物或はこれらを含む基質に乳酸菌を接種し、ｐＨ４．０以上、好ましくはｐＨ４．５以上に保ちながら発酵させて食用素材とするものである。

薬用ニンジンとしてオタネニンジン、アメリカニンジン、エゾウコギ、チクセツニンジン、三七ニンジンなどウコギ科植物、特にＰａｎａｘ属、Ｅｌｅｕｔｈｅｒｏｃｏｃｃｕｓ属、Ｇｙｎｕｒａ属に属する植物、或はこれらの植物の組織培養物などが用いられる。

また、使用する部位もエゾウコギで茎、オタネニンジンやアメリカニンジンなどのその他の薬用ニンジンで根が通常用いられるが、これに限定するものでなく、サポニン類を含むそれ以外の部位も用いることができる。また、これらの薬用ニンジンは、生のまま、又は乾燥したものなど任意の状態のものが利用できる。

発酵処理する前に薬用ニンジンは、先ず破砕、磨砕又は抽出処理する。

破砕又は磨砕するには、薬用ニンジンを直接処理してもよいが、水を加えてから行うのがよい。すなわち、薬用ニンジンをフードカッターなどで細断し、その重量の５０～４００％の水を加え、ミキサーその他公知の破砕機で破砕する、細かくした薬用ニンジンを円盤型磨砕機などの磨砕装置で磨砕する、などの方法で処理する。

抽出は、細断、破砕又は磨砕した薬用ニンジンに使用目的に応じ適量の水を加えて行う。また、アルコール水溶液などの溶媒で抽出した後、減圧濃縮などで溶媒を除き、乳酸菌の繁殖が可能な状態としてもよい。

次に薬用ニンジンの破砕物、磨砕物又は抽出物などの薬用ニンジン処理物に乳酸菌を接種して、発酵させる。この際、使用する乳酸菌として、ヨーグルト、チーズ、漬物などの食品に用いられる乳酸菌など所望に応じ任意の乳酸菌が利用可能である。

なお、薬用ニンジン処理物に野菜や果実の破砕物や汁液、乳製品、茶類、コーヒー、ココア、糖類などの食品原料を加えてから発酵させてもよい。

また、薬用ニンジンの処理物は、雑菌を除き、発酵を円滑に行わせるため、乳酸菌を接種する前に加熱殺菌などの殺菌処理を行うようにするのが望ましい。

発酵は、薬用ニンジンの処理物に、あらかじめ炭酸カルシウムなどの難溶性アルカリ剤を加える、緩衝剤を加える、或は発酵の進行に従いアルカリ溶液をときどき滴下するなど公知の方法で発酵により生じる酸を中和し、ｐＨが４．０以下とならないようにする。しかし、ｐＨが４．０に近い値で発酵を続けると、発酵のわずかな亢進で思いがけないｐＨの低下をきたし、有効成分の減少を起すおそれがあるので、なるべくならｐＨ４．５前後で発酵するのが望ましい。また、発酵によりｐＨが低下し、４．３前後となったら発酵を停止し、４．０以下とならないようにしてもよい。

なお、必要により発酵前の薬用ニンジンの処理物に糖、アミノ酸、ビタミン、ミネラルなどの発

酵栄養源を添加してから発酵を行ってもよい。

発酵は、使用した乳酸菌が増殖し得る温度範囲で行えばよく、それにより薬用ニンジンの風味の改善に効果がみられる。具体的には、２５～４０℃の温度範囲で各々の乳酸菌の至適増殖温度の前後、或はそれより５℃位低い温度で行うのが好ましい。

また、発酵は、静置した状態又は緩やかに撹拌した状態で行うのが好ましく、強く撹拌しながら発酵すると、乳酸の生成が抑えられ、ときには異常発酵による異臭が生じるので、好ましくない。糖その他の発酵栄養源を加えずに発酵させる場合は、原料由来の糖が消費しつくされた時点で発酵を終了しても、風味改善に十分な効果が得られる。しかし、糖などの発酵栄養源を加えて発酵させる場合は、例えば１０⁶個／g程度の菌を接種して１０⁹個／g程度に増殖したとき、又は培養液に対して０.４％程度の乳酸が生成したとき発酵を停止するようにする。しかし、それ以前にても風味の改善が認められ、これにより発酵が進んでも風味に悪い影響が見られないので、所望により任意の段階で発酵を停止することが可能である。

このようにして乳酸菌により発酵した薬用ニンジン処理物は、苦味がなくなり、しかも泥臭さなどの不快臭も感じなくなり、優れた風味の食用素材となる。

発明の効果

この発明により処理した薬用ニンジン発酵物は、例えば実施例１～１５にも示すように、発酵していない薬用ニンジンに比べ風味がよく、好まれるものとなった。従って、例えば、ジュース、ドリンク類、ネクターなどの飲料、シャーベット、アイスキャンデーなどの冷菓類、キャンデー、ゼリー、焼き菓子などの菓子類、スープ、甘酒、味噌、調理食品などの食品を製造するときの素材として利用できる。

しかも、発酵処理物をそのまま利用することにより、薬用ニンジンの繊維質などが含まれたものとなり、繊維質を除いて利用する場合に比べ薬用ニンジンの効果と繊維の効果を有する一層健康保持に適した素材となる。また、発酵した上澄液又は発酵物全体を乾燥して粉末として用いてもよく、水分を嫌うチョコレートや粉末飲料などにも利用できる新しい食用素材とすることも可能である。

しかも、比較試験にもみられるように、単に乳酸菌を加えて発酵した場合、薬用ニンジンの有効成分であるサポニン類が減少し、ときにはほとんど存在しないこともあり得るが、この発明による場合、サポニン類の減少が少なく、保険、健康上の効果が保持されたものとなる。

実施例１～１０

３年もののオタネニンジンの生の根をフードカッターで細断し、３倍量の水を加え、家庭用のミキサーで破砕した。これを１００℃で２０分間加熱して殺菌処理した。この殺菌したオタネニンジンの処理物のｐＨは ５.６であった。次いで、これに表１に示す乳酸菌を接種し、３０℃にて４８時間静置発酵させ、食用素材を得た。

なお、発酵中は定期的にｐＨを測定し、必要に応じ１Ｎ炭酸水素ナトリウム溶液を滴下し、発酵物のｐＨを ４.５以上に保った。

このようにして得たオタネニンジンの発酵物からなる食用素材を用い、その１０部（重量部、以下同じ）にしょ糖１０部、クエン酸 ０.２部及び水８０部を加え、オタネニンジンの飲料を調製した。

各々の乳酸菌で発酵したオタネニンジンを食用素材とした各実施例の飲料と、殺菌処理しただけの発酵前のオタネニンジンの処理物を用い同様に調整して得た比較例の飲料との嗜好の比較を行う官能試験を２５名のパネラーにより行った結果、表１のようになった。

（以下余白）

表1　生オタネニンジンの乳酸菌発酵効果

実施例	乳酸菌の種類	官能検査結果		
		a	b	c
1	ラクトバチルス・コーダルティ	25	0	0
2	ラクトバチルス・ブルガリカス	25	0	0
3	ラクトバチルス・ブレビス	25	0	0
4	ラクトバチルス・カゼイ	23	2	0
5	ラクトバチルス・プランタルム	25	0	0
6	ラクトバチルス・パタラス	25	0	0
7	ロイコノストック・メーゼンテロイデス	23	2	0
8	ロイコノストック・タレモリス	25	0	0
9	ペディオコッカス・ペントサシアス	25	0	0
10	ストレプトコッカス・サーモフィルス	24	1	0

なお、官能検査結果のaは各実施例の乳酸発酵したオタネニンジンを用いた飲料を好むとした人の数、bは各実施例の飲料と比較例の飲料との間に好みの差がないとした人の数、cは乳酸菌処理していないオタネニンジンを用いた比較例の飲料を好むとした人の数をそれぞれ示す。

各発酵液に窒素ガスを吹き込み、テナックス濃縮管に送気して揮発成分を捕集し、ガスクロマトグラムを求めた結果、いずれも未発酵液を同様に処理して得られたガスクロマトグラムに比べ薬用ニンジン特有の臭気の成分であるセスキテルペン類等の量が減少していた。また、各発酵液の上澄み液より分離した粗サポニン量をＳＥＰ－ＰＡＫ Ｃ－１８カラムを使用して測定した結果、いずれも２，０００～２，４００μg／mlであり、薬用ニンジンの未発酵液の ２，５７０μg／mlと比べ発酵によるサポニン類の減少がいずれもわずかであった。

更にまた、各々の発酵液及び未発酵液の上澄み液より粗サポニンを分離し、分離した粗サポニンをシリカゲルの薄層クロマトグラフィー（展開液 n－ブタノール：酢酸エチル：水＝４：１：５）により分離し、クロマトスキャナー（島津ＣＳ－９２０）で各スポットの大きさを測定した。その結果、未発酵液のスポットを １.０として各発酵液の相当するスポットを相対値で求めると、いずれも０.８～１.３の範囲にあり、ほぼ等しかった。

実施例１１～１５

組織培養したオタネニンジンのカルスに等量の水を加え、家庭用のミキサーで破砕した。

次いで、これを１００℃、２０分間加熱殺菌してから表２に記載の乳酸菌を接種し、３７℃にて４８時間発酵させた。

なお、発酵中は定期的にｐＨを測定し、必要に応じ１Ｎ炭酸水素ナトリウム溶液を滴下し、ｐＨ４.５以上に保った。

このようにして得た発酵液は、いずれも未発酵の殺菌液に比べ苦味が少なく、しかも泥臭さがなく、ヨーグルトに似た甘い香りあるいはさわやかな酸臭を帯びた好ましい風味となった。

このオタネニンジンの発酵物の上澄み液を素材とし、その１０部にしょ糖１０部、クエン酸０.２部、水８０部を加え飲料を調製した。

この実施例のオタネニンジン飲料と、未発酵のオタネニンジンカルスを各実施例の発酵液と同様にして調製した比較例の飲料との嗜好を比較する官能検査の結果は、表２のようになった。

表２　オタネニンジンカルスの乳酸菌発酵

実施例	乳酸菌の種類	官能検査結果		
		a	b	c
11	ロイコノストック・メーゼンテロイデス	21	4	0
12	ペディオコッカス・ペントサシアス	25	0	0
13	ラクトバチルス・カゼイ	19	6	0
14	ラクトバチルス・パタラス	21	4	0
15	ラクトバチルス・プランタルム	21	4	0

なお、官能検査結果は、表１と同様に、aは実施例の乳酸発酵したオタネニンジンを用いた飲料を好むとした人の数、bは実施例の飲料と比較例の飲料との間に好みの差がないとした人の数、cは乳酸菌処理していないオタネニンジンを用いた比較例の飲料を好むとした人の数をそれぞれ示す。

実施例１６

エゾウコギの乾燥物１０部を破砕し、９０部の５０％エチルアルコール水溶液に加え、３５℃で２０日間浸漬後抽出液を分離し、エバポレーターを用いて減圧濃縮し、１０部の濃縮抽出液を得た。

ここに得た濃縮抽出液１０部に対し、５％ぶど

う糖溶液１０部及びイーストエキス ０.２部を加え、１００℃にて１５分加熱殺菌した。

次いで、殺菌処理した濃縮抽出液にペディオコッカス・ペントサシアスを接種し、３５℃にて２４時間静置発酵させた。２４時間後に発酵液のｐＨが ４.３となったので、加熱処理して発酵を停止させた。

この発酵液を素材として用い、その１０部としょ糖１０部、クエン酸 ０.３部及び水８０部を混ぜ、エゾウコギの飲料とした。このエゾウコギの飲料は、苦味がなく、まろやかな好ましい風味のものとなった。

比較試験結果

組織培養したオタネニンジンのカルスに等量の水を加え、家庭用のミキサーで破砕した。次いで、これを１００で２０分間加熱殺菌してからラクトバチルス・プランタルムを接種し、３７℃にて静置発酵させた。

発酵に従いｐＨが低下し、７２時間後にはｐＨ３.７となった。この発酵途中の発酵液をｐＨの低下に従い順次サンプリングし、ジンセノサイドの量を測定した。

ジンセノサイド量の測定は、各サンプルより分離した粗サポニンをシリカゲル薄層プレートにスポットし、ｎ－ブタノール：酢酸エチル：水＝４：１：５の混合溶液を展開液として展開した後硫酸を噴霧して１０５℃、５分間加熱して発色させ、クロマトスキャナーを用いて各スポットの量を求め、未発酵液を同様に処理した比較試料のスポットの量を１.０としたときの相対値として求めた。測定の結果は、表３の通りである。

なお、対照は、比較例の試料に乳酸を加え、混合してｐＨ３.０としたものである。

表３　ジンセノサイドの相対量

試　料	発酵時間	ｐＨ	A	B	C
比較（未発酵液）	0	5.6	1.0	1.0	1.0
試　料　1	12	4.8	0.8	1.0	1.1
試　料　2	24	4.4	0.5	1.0	0.4
試　料　3	36	4.0	0.5	0.2	0.3
試　料　4	72	3.7	0.2	0	0
対照（乳酸添加）		3.0	0	0	0

なお、表３のＡ及びＣは、Ｒｆ値が０.６７及び０.３５のスポットを、またＢは０.５７と０.５２のスポットの和をそれぞれ示す。また、Ａは、ジンセノサイドＲｇ₁に相当するスポットである。

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